

The Claims

Please cancel claims 1-21 without prejudice, and add new claims 22-43. No new matter has been added by addition of new claims 22-43—each is fully and unambiguously supported in the original specification.

We claim:

*A* 23. A wellbore fluid of the water-in-oil emulsion type comprising a discontinuous

*SUB B1* 5 aqueous or brine phase, solids such as clays or weighting material and having a non-aqueous continuous liquid phase that comprises a polar organic liquid POL which exhibits a dielectric constant of at least about 5.0 and a Hildebrand Solubility Parameter of at least about  $17 \text{ (J cm}^{-3}\text{)}^{1/2}$  so that the liquid phase exhibits an electrical conductivity of not less than  $10 \mu\text{S m}^{-1}$  at 1 kHz.

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24. A wellbore fluid as in claim 23, wherein the non-aqueous liquid phase further comprises a water immiscible organic liquid OL.

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25. A wellbore fluid as in claim 24, wherein the non-aqueous liquid phase is comprised of 1 to 99% by volume of POL + 99 to 1% by volume OL, and more preferably of 5 to 95% by volume of POL and 95 to 5% by volume of OL.

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26. A wellbore fluid as in claim 23, wherein the non-aqueous liquid phase further comprises a dissolved component (DC) selected from: water; inorganic salts wherein the anion(s) is (are) a conjugate base of an acid whose dissociation constant ( $\text{pK}_a$ ) in water at 298 °K is less than about 1.0, and the cation is ammonium ion or a metal ion which has an ionic radius of less than about 2/3 of the ionic radius of the pre-selected anion; quaternary ammonium salts or hydroxides; N-alkyl pyridinium salts or hydroxides; and organic bases exhibiting a  $\text{pK}_a$  in water at 298 °K of more than 10.0, and their salts.

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27. A wellbore fluid as in claim 26, wherein the non-aqueous liquid phase comprises of about 0.1 % to about 50% by volume of the dissolved component DC.

28. A wellbore fluid as in claim 27, wherein the non-aqueous liquid phase comprises  
5 1 to 98.5% by volume POL, 1 to 98.5% by volume OL and 0.5 to 50% by volume DC.

29. A wellbore fluid as in claim 23 wherein the polar organic liquid POL is one or  
more selected from the class including alcohols, phenols, glycols, polyalkylene glycols,  
mono (alkyl or aryl) ethers of glycols, mono (alkyl or aryl) ethers of polyalkylene  
glycols, monoalkanoate esters of glycols, monoalkanoate esters of polyalkylene glycols,  
5 ketones possessing also hydroxyl group(s), diketones.

30. A wellbore fluid as in claim 23, wherein the polar organic liquid POL component  
is selected from the class including:

- aliphatic and alicyclic alcohols of carbon numbers C<sub>5</sub>-C<sub>10</sub> such as *n*-pentanol,  
5 cyclohexanol, *n*-octanol, 2-ethylhexanol, and *n*-decanol;
- phenols such as orth-, meta-, or para-cresol;
- glycols such as 1,3-butane diol, 1,4-butane diol, 2-ethylhexane-1,3-diol;
- polyalkylene glycols such as polypropylene glycols of molecular weight above about  
1000, polybutylene glycols, polytetrahydrofuran, polyalkylene glycols or copolymers  
10 of ethylene oxide and/or propylene oxide and/or butylene oxide initiated by any  
hydroxylic or amino-functional moiety wherein the polyalkylene glycol or copolymer  
is further characterised by exhibiting a cloud point (at 1% concentration in water) of  
less than about 10 °C;
- mono-alkyl or mono-aryl ethers of glycols or polyalkylene glycols such as ethylene  
15 glycol monobutyl ether, diethylene glycol monobutyl ether, dipropylene glycol  
monomethyl ether, tripropylene glycol monomethyl ether, propylene glycol  
monobutyl ether, dipropylene glycol monobutyl ether, tripropylene glycol monobutyl  
ether, propylene glycol phenyl ether, dipropylene glycol phenyl ether;

• diacetone      alcohol      (4-hydroxy-4-methyl-1,2-pentanone);      acetylacetone;  
20      acetonylacetone.

31. A wellbore fluid as in claim 23, wherein the polar organic liquid POL is an aprotic solvent.

32. A wellbore fluid as in claim 26 wherein the inorganic salt comprises anions which are the conjugate base of an acid selected from the class including hydrochloric acid; hydrobromic acid; hydroiodic acid; thiocyanic acid; perchloric acid; nitric acid; permanganic acid; sulphuric acid; alkane sulphonic acids such as methane sulphonic acid and ethane sulphonic acid; arene sulphonic acids such as benzene sulphonic acid and naphthalene sulphonic acid; alkylaryl sulphonic acid such as toluene sulphonic acid; alkane and arene sulphonic acids substituted with electron-withdrawing groups such as trifluoromethane sulphonic acid and 2,4-dinitrobenzene sulphonic acid; picric acid and trichloracetic acid.

33. A wellbore fluid as in Claim 26 wherein the quaternary ammonium salts or hydroxides are the chlorides, bromides, iodides, methosulphates, ethosulphates or hydroxides of quaternary ammonium cations having alkyl and/or aryl and/or alkylaryl groups such that the total number of carbon atoms in all the groups combined with the 5 nitrogen atom is in the range 8 to 60, and more preferably in the range 12 to 40.

34. A wellbore fluid as in Claim 26 wherein the organic base(s) exhibiting a  $pK_a$  in water of more than 10.0 is selected from the class including mono-, di-, and tri-alkylamines wherein the alkyl groups contain from 2 to 18 carbon atoms; alkylpiperidines; alkylpyrrolidines; N-alkylated ethyleneamines; and their salts.

35. A wellbore fluid of the water-in-oil emulsion type comprising a discontinuous aqueous or brine phase, solids such as clays or weighting material and having a non-aqueous continuous liquid phase that comprises that comprises from about 99.5% to about 50% by volume of a water immiscible organic liquid OL and about 0.5% to about 5% by volume of a dissolved component (DC) selected from: water; inorganic salts wherein the anion(s) is (are) a conjugate base of an acid whose dissociation constant

( $pK_a$ ) in water at 298 °K is less than about 1.0, and the cation is ammonium ion or a metal ion which has an ionic radius of less than about 2/3 of the ionic radius of the pre-selected anion; quaternary ammonium salts or hydroxides; N-alkyl pyridinium salts or hydroxides; 10 and organic bases exhibiting a  $pK_a$  in water at 298 °K of more than 10.0, and their salts, said continuous liquid phase exhibiting an electrical conductivity of not less than 10  $\mu$ S  $m^{-1}$  at 1 kHz.

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26. A wellbore fluid as in claim 23, wherein the water immiscible organic liquid OL is one, or a mixture of two or more, liquid(s) selected from the class including crude oil; hydrocarbon fractions refined from crude oil; synthetic hydrocarbons such as *n*-paraffins, alphaolefins, internal olefins, and polyalphaolefins; synthetic liquids such as dialkyl ethers, alkyl alkanoate esters, acetals; and natural oils such as triglycerides including 5 rape-seed oil, sunflower oil and the like.

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37. A wellbore fluid as in claim 35, wherein the water immiscible organic liquid OL is one, or a mixture of two or more, liquid(s) selected from the class including crude oil; hydrocarbon fractions refined from crude oil; synthetic hydrocarbons such as *n*-paraffins, alphaolefins, internal olefins, and polyalphaolefins; synthetic liquids such as dialkyl ethers, alkyl alkanoate esters, acetals; and natural oils such as triglycerides including 5 rape-seed oil, sunflower oil and the like.

38. A wellbore fluid as in claim 23 wherein a discontinuous liquid phase such as water or a brine is added together with one or more emulsifier to form a water-in-organic-liquid emulsion wherein the discontinuous phase is present at up to 70% by volume of the emulsion.

39. A wellbore fluid as in claim 23 wherein it further comprises a dispersion in the wellbore fluid of finely divided particles of an electrically conducting solid insoluble in the organic liquid or water.

40. A wellbore fluid as in Claim 39 wherein the finely divided electrically conducting 5 solid is selected from the class including metals; carbon preferably in the form of graphite

or carbon fibre; metal coated carbon fibre or graphite; conductive polymers such as polyaniline, polypyrrole, organometallic phthalocyanines and the like.

41. A wellbore fluid as in Claim 40 wherein the finely divided conducting solid is in the form of high aspect ratio fibres, flakes or platelets.

42. A wellbore fluid as in claim 23 further comprising a functional wellbore fluid components such as clay, organoclay or polymeric viscosifiers; filtration reducers, weighting agents or a lubricating additive.

43. A method of drilling or completing a well wherein the used wellbore fluid is of the water-in-oil emulsion type comprising a discontinuous aqueous or brine phase, solids such as clays or weighting material and having a non-aqueous continuous liquid phase that comprises a polar organic liquid POL which exhibits a dielectric constant of at least about 5.0 and a Hildebrand Solubility Parameter of at least about 17 ( $J \text{ cm}^{-3}\right)^{1/2}$  so that the liquid phase exhibits an electrical conductivity of not less than  $10 \mu\text{S m}^{-1}$  at 1 kHz

44. A method of providing enhanced information from electrical logging tools, measurement while drilling, logging while drilling, geosteering and the like wherein the efficiency is enhanced by the improved electrical conductivity of a of the water-in-oil emulsion type comprising a discontinuous aqueous or brine phase, solids such as clays or weighting material and having a non-aqueous continuous liquid phase that comprises a polar organic liquid POL which exhibits a dielectric constant of at least about 5.0 and a Hildebrand Solubility Parameter of at least about 17 ( $J \text{ cm}^{-3}\right)^{1/2}$  so that the liquid phase exhibits an electrical conductivity of not less than  $10 \mu\text{S m}^{-1}$  at 1 kHz

Remarks

10 Original claims 1 through 22 have been deleted and replaced by claims 23 through 44.

Accordingly, early action and allowance of this application are requested respectfully.